



# MAINSTREAMING RAINWATER HARVESTING



PROCEEDINGS OF  
XII INTERNATIONAL RAINWATER CATCHMENT  
SYSTEMS CONFERENCE 2005



## Significance of the logo of XII International Rainwater Catchment Systems Conference 2005



आपो ज्योति रसः

**Water is the most important of all the elements:  
the essential element for any living being**

The water drop symbolizes purity and cleanliness. Dark rain bearing clouds bring abundance of water. This rainwater is collected, stored and flows to nurture trees, which represent nature and life. The lines at the bottom of the drop signify the service rendered by water to all living beings.

The whole symbol encompasses the feelings of joy, happiness and prosperity that arise on account of the availability of water.

This logo was designed for XII International Rainwater Catchment Systems Conference 2005 by prominent artist Mr. Narendra Srivastava.

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*Environnement*



आपो ज्योति रसः

Proceedings of  
The XII International  
Rainwater Catchment Systems  
Conference 2005

**'MAINSTREAMING RAINWATER HARVESTING'**







## Acknowledgements

It gives me immense pleasure and happiness to thank the delegates and invitees who participated in the XII International Rainwater Catchment Systems Conference, and all those involved in conducting it. Addressing a highly relevant topic like "Mainstreaming Rainwater Harvesting" through a conference of such magnitude was a challenge. I am happy to say that we were able to accomplish the giant task with distinction, despite our limited resources.

The untiring efforts of all those involved in organizing this conference was rewarded by intense participation by the delegates. They represented a variety of international and Indian organizations, of technical and academic specializations, of civil society interests; all having a common concern or relation with Rainwater Harvesting. The papers presented in six thematic heads addressed multifarious issues concerning the topic, and provided a launching pad for earnest dialogue on international efforts and strategies in the area, and the need to integrate Rainwater Harvesting with planning and management of water resources at every level.

The conference managed to unite ordinary citizens from across the globe for promoting a coordinated effort in Rainwater Harvesting. The underlying passion was the love for water; the motivation was to awaken an oblivious modern world, both to the threat of its scarcity, and to the thus far wasted opportunity of harvesting rainwater. We have reached only a minor portion: continuous efforts are needed right from the highest levels of the government and private sector, down to individual farmers, women and children. Rainwater Harvesting should not die the death of an unheeded slogan.

Representatives from among the delegates finalized the Conference Recommendations, after three sessions of participative discussions on a Framework for Mainstreaming Rainwater Harvesting. I am sure these Recommendations and the Framework form a guiding principle for all, across the globe, who seek to work on Rainwater Harvesting in an organized and coordinated manner.

I am immensely grateful to Mrs. Sheila Dikshit, Hon'ble Chief Minister, Government of Delhi, for chairing the Valedictory Session wherein Conference Recommendations were presented to her, and appreciate the keen interest shown by her in the proceedings. I am also especially grateful to Dr. A. K. Walia, Minister for Finance, Planning, PWD and Urban Development, Government of Delhi who inaugurated the conference and spoke on the importance of Rainwater Harvesting, with particular reference to urban areas. I also thank Mr. Sompal, Former Union Minister for Water Resources and Agriculture, for making it convenient to attend both the inaugural and plenary sessions, and captivating the delegates and invitees with ardent speeches focusing on the present water scenario and the need for civil society movements. A special word of thanks also for Dr. V. B. Kathiria, Member of Parliament, who made a presentation on the utility of rainwater harvesting at local levels.

In a special way, we acknowledge Mr. Mani Shanker Aiyar, Honorable Union Cabinet Minister, Petroleum & Natural Gas, and Panchayati Raj, Government of India, and Mr. Priya Ranjan Dasmunsi, Honorable Minister of Information & Broadcasting, and Parliamentary Affairs, Government of India, who was till recently the Union Cabinet Minister for Water Resources, Government of India, for their sincere interest in the conference. They had communicated willingness to chair different sessions of the conference, but were



forced to change their program due to last minute engagements. We thank them profusely, and will continue to seek their support for Mainstreaming Rainwater Harvesting.

I am thankful to all the other speakers of the inaugural and plenary sessions - Dr. Jessica C. Salas, Fr. John Noronha, Dr. Bindeshwar Pathak, Mr. R. Ramaswamy Iyer, Dr. Hari J. Krishna, Mr. Ron Denham, Dr. B. R. Sharma, Dr. Luiz Palmier and Dr. Terry Thomas. Thanks to all the chairpersons and co-chairpersons of the technical sessions.

A special word of appreciation and thanks is due for all those who presented papers, posters and put up exhibitions during the conference. Their effort, which was the core of the conference, required long hours of committed study and research.

The delegates and participants of the conference deserve special appreciation for making it convenient not only to attend the conference, but also for taking an active part in the presentation of papers, discussing key issues and finally assisting in finalizing Conference Recommendations. That 24 countries were represented stands out as a testimony that Rainwater Harvesting as a technology has come of age across the globe. These participants traveled great distances for the promotion of Rainwater Harvesting, which is reason enough to believe that the technology will get the impetus it needs from their continued and impassioned advocacy.

A special mention must be made of the many Indian NGOs who traveled across the country to participate in this conference. We thank them for their wholehearted interest in the theme, and feel assured that they will advocate Rainwater Harvesting in their respective regions and support communities to adopt this technology.

We thank UNICEF, New Delhi for presenting a unique interactive session of school children. We also thank UNICEF, Jaipur and GVNML, Jaipur who arranged a special cultural event by children based on the theme "Water" at the Inaugural Dinner. The children who participated in both these events deserve special accolades and appreciation for their enthusiastic presentations.

A special thanks to the Central Ground Water Board, Ministry of Water Resources, Government of India, Indian Airlines, Indian Institute of Technology - Delhi, Jawaharlal Nehru University, New Delhi Municipal Corporation, Sehgal Foundation, ITC Limited, International Development Enterprise (India), for opening their doors to the delegates making Technical Field Visits.

We gratefully acknowledge the generosity shown by the international and national organizations that provided funding support to the conference or sponsorship for delegates. Simply put, without their support, the conference would not have been possible. They included the Ministry of Environment and Forests, Government of India, Ministry of Water Resources, Government of India, Misereor, Caritas India, Christian Aid, Corporation Bank, Department of Land Resources, Ministry of Rural Development, Government of India, Planning Commission, Government of India, United Nation's Children's Fund (UNICEF), World Health Organization (WHO), National Bank for Agriculture and Rural Development (NABARD), Delhi Jal Board, Council for Scientific and Industrial Research, Church Development Services (EED), Indian Social Institute (ISI), Indo Global Social Service Society (IGSSS), Inter Church Organization for Development Cooperation (ICCO), Lutheran World Relief (LWR), Sehgal Foundation, Arghyam Trust and Swiss Agency for Development and Cooperation (SDC). I, therefore, express my sincere appreciation to all of them.

This conference has been organized under the aegis of International Rainwater Catchment Systems Association, a unique civil society movement started two decades ago for the promotion of Rainwater Harvesting. We thank them for giving us this opportunity to host this conference in India. AFPRO is an Indian NGO that has been working for four decades in the area of water and watershed management. The region and the subject, both are very dear to us.



We also thank Water Supply and Sanitation Collaborative Council, Geneva, Switzerland and Akash-Ganga Trust, Chennai, India, our organizing partners for all the encouragement and help rendered by them.

AFPRO's Governing Body, Donor Consortium, and Partners provided unwavering support and encouragement for conducting this conference. Many of these friends volunteered to help in various capacities. AFPRO employees put up late hours for many days at a stretch for ensuring that the conference has a smooth run. We are thankful to them all. A special word of thanks and appreciation goes to all those who helped in the selection of papers for the conference.

A special round of applause needs to be given to the Media who provided good coverage to the conference. This fact reflects the urgent relevance of the topic today. The conference was reflected in various newspapers like the Asian Age, the Times of India, the Hindu, and other national and regional newspapers. Doordarshan, the National Television Channel also carried reports on the conference. We thank all the media agencies that carried reports on the conference for supporting the cause.

We also acknowledge the efforts of SITA MICE, our event managers, Hotel Intercontinental Eros, and Brightlite Communications, our media advisor.

As the issue of water shortage becomes graver by the day, the need for greater networking and cooperation for coordinated implementation of the technology, especially at the grassroots for the benefit of the poor and marginalized is immense and demands immediate action.

It is now needed that the awareness and passion generated by the conference fructifies into a globally coordinated and advocated movement for Rainwater Harvesting, which is nationally and regionally adopted and supported, as well as locally facilitated and implemented. We hope that it will eventually culminate into a cultural continuum woven into the fabric of humanity. This will ensure that we give Water, among the most precious of God's gifts, the dignity due to it.

**D.K. Manavalan**  
Executive Director, AFPRO



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## Executive Summary

The XII International Rainwater Catchment Systems Conference 2005 was held under the aegis of International Rainwater Catchment Systems Association (IRCSA) from 15th to 18th November 2005 in Hotel Intercontinental Eros, Nehru Place, New Delhi, India. The conference on "Mainstreaming Rainwater Harvesting" was attended by nearly 500 participants comprising of rainwater harvesting practitioners, technical experts, academicians, administrators, politicians, farmers, students, journalists, representatives of civic bodies, and corporate sectors from 24 countries around the globe.

This document presents a summary of the proceedings of the conference. It includes the views expressed during inaugural and plenary sessions by invited experts, salient features of the technical sessions and a special UNICEF sponsored school children session, and briefs of the technical field visits and exhibition conducted on the third day, Conference Recommendations, and finally, the importance attached to event by the media. In addition, the list of technical papers presented, a framework for Mainstreaming Rainwater Harvesting and the list of delegates are also included. The technical papers were circulated earlier along with the Conference Souvenir.

The conference was inaugurated by Dr. A. K. Walia Honorable Minister for Finance, Planning, PWD and Urban Development, Government of Delhi. The presidential address was delivered by Mr. Som Pal, Former Member of Planning Commission & Minister of State for Agriculture (Additional Charge of Water Resources). The Inaugural session was addressed by Dr. Jessica C. Salas, President of IRCSA, Fr. John Noronha, Executive Director, CARITAS India,



and Dr. Bindeshwar Pathak, Chairman, Sulabh International. The inaugural session was followed by the plenary session graced by expert speakers in the field of Rainwater Harvesting and included Dr. V. B. Kathiria, Member of Parliament, India, Mr. Ramaswamy Iyer, Former Secretary, Ministry of Water Resources; Dr. Hari J. Krishna, Executive Vice-President, IRCSA; Mr. Ron Denham from Rotary International; Dr. B. R. Sharma from International Water Management Institute; Dr. Luiz Palmier, Asst. Professor, Federal University of Minas Gerais; and Dr. Terry Thomas, Head of Development Technology Unit, University of Warwick and IRCSA Board Member. These experts highlighted main issues of the theme and provided a frame for eliciting views of the





delegates and consolidating these into final recommendations.

Delegates from different organizations varying from Government, non-Government, corporate sector, self help groups, international organizations like UNICEF, WHO, Plan International, universities, schools and individuals from across the globe participated in the conference on "Mainstreaming Rainwater Harvesting". The presentations from invited speakers and authors of the papers in the conference reiterated the tremendous potential of rainwater harvesting to add significantly to the continuously dwindling water resources of the world. Rainwater Harvesting is being seen as an appropriate low cost technology, accessible to both the poor and the better off. Its simplicity makes it popularly acceptable. The need, therefore, is to dovetail it with sector reform, adequate infrastructure facilities, participatory water management, institutional capacity building, and women's empowerment. The papers presented during the conference reflected the considerable amount of work done in different parts

of the world in this field; these can be replicated with suitable modification as per the local situations. Success stories of Rainwater Harvesting across the globe shared during the conference, further fortified the belief of its universal adoption.

The delegates had the freedom to choose between 57 papers that were presented under 6 technical themes addressed through parallel sessions over the first two days. They were also able to take a look at the Posters presented and the Exhibition.

They had the pleasant experience of observing presentations by school children from three schools located in the Indian states of Rajasthan, Tamil Nadu and Kerala in a session sponsored by UNICEF. This was an interactive session which turned out to be a novel experience for the delegates to learn from these little ambassadors of Rainwater Harvesting.

Another feature of the conference was participative discussions for Conference Recommendations in three sessions specially focussing on an acceptable framework for Mainstreaming Rainwater Harvesting.



On the third day of the conference, the delegates were given an opportunity to visit real-life models of Rainwater Harvesting in different environs made by the Government, Corporate and Voluntary sectors. These included those created in urban areas within Delhi by Central Ground Water Board and other organizations with technical advice from it in urban areas of Delhi, the Green Centre of ITC in the city Gurgaon of Haryana State, and Integrated Water Management facilities by Sehgal Foundation in villages of Mewat region in the same State, models in rural areas of Delhi by International Development Enterprises.

The deliberations of the technical sessions, feedback sessions and framework sessions culminated in "Recommendations for Mainstreaming Rainwater Harvesting" compiled and finalized by volunteer delegate representatives. These were presented to Mrs. Sheila Dikshit, Honorable Chief Minister of Delhi.

## Salient Features of Technical Sessions

Rainwater Harvesting, whether through huge water catchments, individual households or even smaller forms like water pockets, needs to be taken up internationally, both in rural and urban sectors.

Rainwater Harvesting is not a new concept, but rather is traditional wisdom that needs to be revived. This fact, in itself, provides a sound base for its implementation and social acceptability.

The utility of adopting Rainwater Harvesting, even in areas that are already endowed with substantial water resources and a favorable quantum of rainfall, will provide water security during periods of erratic supply, and will minimize flooding and surcharging of storm water drains.

The linkages of Rainwater Harvesting with natural resource management, governance, legislation and sops, institutional framework, technology, economy were raised and discussed. The need for involvement of local governments and institutions was strongly reiterated. That all stakeholders' had a role and

needed to be involved in developing a strategy for Rainwater Harvesting was emphasized. Appropriate regulatory mechanisms like modifying building by-laws, implementing groundwater regulation and rationalizing water cess, and incentives like subsidies and tax rebates were suggested for adoption by local governments. Widespread awareness building and sharing of Rainwater Harvesting technology was repeatedly recommended. The impact of globalization, market economy and privatization of water sources, were deliberated upon. A few papers even addressed the issues of costing of harvested rainwater.

Women, in most cultures and traditions, have the role of primary collector and manager of water, especially in rural areas. Thus they play an important and influential part in the judicious management of water. Guaranteeing women's rights to fresh water will ensure a direct impact on the community. Specific campaigns, educational and capacity building programs, publicity activities, etc. need to be taken up to empower women and facilitate their participation in Rainwater Harvesting.

Approaches to be adopted in rural areas, urban areas and industries may differ vastly despite common features being present. There is need to develop a permanent database for implementation of technically feasible Rainwater Harvesting schemes.







*Mrs. Sheila Dikshit, Hon'ble Chief Minister of Delhi, addressing the delegates at the Valedictory Session*

The database should include up-to-date information like rainfall patterns and intensity, geological and hydrogeological setup, topographic details, availability of source water and local water balance, water availability scenario, water quality details etc. Technological innovations like Remote Sensing and GIS too is a must. Technical experts, working in close consultation stakeholders, using both indigenous and modern means, should make locally appropriate designs. The aim is to make Rainwater Harvesting cost-effective and viable.

Centers need to be set up at different locations for creating awareness, providing technical designs and suggestions, and evaluation and monitoring. Called 'Rain Centers', these will be an important cogwheel in popularizing and operationalizing Rainwater Harvesting.

Media, both print and electronic, need to be sensitized about the thus far underestimated threat of water scarcity, and the potential of Rainwater Harvesting to meet mitigate this threat. While periodic droughts and water shortages are covered, the magnitude of imminent water crisis needs to be publicly monitored. In addition to these seemingly negative aspects, success stories of water scarcity amelioration, particularly through environmentally sound efforts like Rainwater Harvesting should be covered and highlighted in media. In fact, like sports and crime correspondents, Water journalists too must be groomed to inform the public about water news.

Water quality issues in Rainwater Harvesting, like protection and regular monitoring of collected water, and improving its potability, are necessary aspects in mainstreaming Rainwater Harvesting.

Community management is the key to success for water related projects. Each individual in every community is to be recognized as a stakeholder, and should be made aware of the importance of Rainwater Harvesting in mitigating water scarcity. Various means of educating people, such as group discussions, audio-visual media, field visits to applied models, seminars and workshop etc. need to be employed. Rainwater Harvesting education should be included in school curriculum.

Economic incentives need to be introduced so as to promote Rainwater Harvesting. The government and non-governmental organizations should play the role of basic initiation and facilitation of such incentives. Financial institutions and banks must introduce financial schemes for local level implementation of Rainwater Harvesting. On the beneficiaries' part, Water User Associations have to be set up and trained on various aspects of Rainwater Harvesting. They should ensure equitable distribution of water received from Rainwater Harvesting, and monitor the community managed structures. Importantly, they should strictly monitor groundwater withdrawal, as the groundwater recharged through Rainwater Harvesting efforts is part of Common Pool resources.



*A stall at the Exhibition*



## Inaugural Session

The XII International Rainwater Catchment Systems Conference was inaugurated by the Chief Guest, Dr. A.K. Walia, Honorable Minister for Finance, Planning, PWD and Urban Development, Government of Delhi, who lead the ceremony by lighting the lamp. The other dignitaries who were present on the dais included, Mr. Som Pal, Formerly Member of Planning Commission & Minister of State for Agriculture (Additional Charge of Water Resources), Dr. Jessica C Salas, President of the International Rainwater Catchment Systems Association (IRCSA), Fr. John Noronha, Vice President, AFPRO Governing Body and Executive Director, CARITAS India, Dr. Bindeshwar Pathak, Founder - Chief Functionary, Sulabh International, Mr. D.K. Manavalan, Executive Director, Action for Food Production (AFPRO), Dr Hari J. Krishna, Executive Vice-President, IRCSA, and Mr. Ram Krishnan, Director, Akash Ganga Trust.

Mr. D. K. Manavalan, welcomed invited guests and participants to the XII International Rainwater Catchment Systems Conference with the message that there is an immediate need of convergence and networking among all countries for sharing of low-cost Rainwater Harvesting technologies.

Rainwater Harvesting is urgently needed for augmenting water resources in a world threatened by water scarcity. Achieving an acceptable balance between people and water with equitable and just distribution, specially addressing the needs of poor communities, is a global priority. The conference has provided a platform for sharing of experiences and initiating a plan for mainstreaming the Rainwater Harvesting.

Building of large dams, an activity that dominated the last century, has inadequacies, especially the irreversible effects on the ecosystem. India receives



Artists from Gandharva Mahavidyalaya, making the Invocation





Mr. D. K. Manavalan, Executive Director, AFPRO



Fr. John Noronha, Vice-President, Governing Body AFPRO and Executive Director, CARITAS India

the same amount of rainfall in the monsoon months as does USA over the entire year: dams only store a fraction of this water, most of which ends up as runoff to the sea. The era of dams may have passed and countries would need to resort to Rainwater Harvesting for water supply.



Dr. Jessica C. Salas, President, IRCSA

in water harvesting is a boon for them, and many already practice traditional Rainwater Harvesting methods. An innovative and integrated approach to Rainwater Harvesting is needed as this will help poverty reduction. "Catch Water and Save Life", is a simple yet appropriate slogan,

that conveys the seriousness of the problem of water shortage and the need for rainwater harvesting.

**Dr. Jessica C. Salas**, briefly recounted the origins of Association, its work and focus. Initiated 23 years ago, IRCSA has aimed for the promotion of simple techniques for water resource development. Since 2000, it has focussed on promoting of economical and viable models for Rainwater Harvesting, and create public awareness about the need for Rainwater Harvesting and the technology available for it. It is also involved in policy advocacy with International Organizations and Forums on the same issue and has interacted with the United Nations and the World Water Forum in the immediate past.

**Dr. Bindeshwar Pathak**, reflected on the problem of sanitation in India and the relevance of Rainwater Harvesting for addressing it. The indignity of living without proper access to water and sanitation is immeasurable. Water is life and should be saved for the sake of every individual.

**Fr. John Noronha**, spoke about the influence of water shortage on livelihoods of poor rural communities, which directly limited food production. Rather than lack of rainfall, it is the inappropriate manner of utilization that results in water scarcity. The involvement of local communities

Water and sanitation are directly connected. Also, existing water resources need to be protected from pollution by human excreta; efficient sanitation systems that recycle the human excreta for use as fertilizers, nutrients and similar products need to be designed. A behavioural change has to be brought about among the millions in India who resort to open defecation as an age-old practice. This will also free the thousands who are involved in the task of manual scavenging.



**Mr Som Pal**, Former Member, Planning Commission and Minister of State for Agriculture (Additional Charge of Water Resources), made the Presidential address. He spoke widely on the imbalances in water availability which could be offset by Rainwater Harvesting. A huge gap exists in drinking water consumption of urban and rural areas. Shortage of water has a direct bearing on food scarcity. A sustainable and effective method of dealing with these aspects is rainwater harvesting through watershed management.

The development and management of water is besieged with numerous problems like inadequate funds, lack of suitable strategy and policy, to name a few. The need for demand-supply management of water stands out as the solution for water scarcity. Simple techniques of rainwater harvesting will help in replenishment of water sources around the world. All sectors - government, corporate, and voluntary need to be involved in mainstreaming rainwater harvesting on a large scale. The financial requirements for this will require adequate budgetary allocations.

A global culture of harvesting, conserving and consuming water is necessary. In this regard,

local cultures would directly bear upon the practices of water preservation. Traditional knowledge must be tapped. The issue of Rainwater Harvesting has to be taken up as a people's movement for it to be successfully adopted. This needs to be supplemented by efficient water management practices by adoption of simple innovative technologies. At the same time, water contamination is an issue that needs to be addressed. The protection of environment, too, is closely linked with Rainwater Harvesting.

**Dr. A. K. Walia**, Hon'ble Minister for Finance, Planning, PWD and Urban Development, Government of Delhi, Chief Guest, voiced a strong concern over the need to make Rainwater Harvesting a priority. This was a special need in Delhi for recharging the groundwater resources where a lot of groundwater development has taken place. Delhi is facing the twin problems of scarcity and pollution of groundwater resources.

Large-scale implementation of Rainwater Harvesting can mitigate the problems to larger extent. Municipal Corporation of Delhi has been instructed to make Rainwater Harvesting mandatory in all the new buildings that have a roof area of more than 100 square meters.

*Dr. Bindeshwar Pathak, Founder-Chairman, Sulabh International. In the background is Mr. Ram Krishnan, Director, Akash Ganga Trust*



*Dr. A.K. Walia, Hon'ble Minister for Finance, Planning, PWD and Urban Development, Government of Delhi, addressing the gathering*



*Mr. Som Pal, Formerly Member, Planning Commission & Minister of State for Agriculture (Additional Charge of Water Resources)*



## Plenary Session

The plenary session was chaired by Mr. Sompal, Formerly Member of Planning Commission & Minister of State for Agriculture (with Additional Charge of Water Resources). The speakers included Dr. V. B. Kathiria, Member of Parliament, India; Mr. Ramaswamy Iyer, Former Secretary, Ministry of Water Resources, Govt. of India; Dr. Hari. J. Krishna, Executive Vice-President, IRCSA; Mr. Ron Denham, General Coordinator, Water Resource Task Force, Rotary International; Dr. B. R. Sharma, Senior Researcher, International Water Management Institute; Dr. Luiz Palmier, Asst. Professor, Federal University of Minas Gerais; and Dr. Terry Thomas, Head of Development Technology Unit, University of Warwick and IRCSA Board Member.

**Mr. Ramaswamy Iyer** presented the theme of the conference "Mainstreaming Rainwater Harvesting" in a larger perspective of sustainable approaches for demand and supply of water in the Indian context.

There is an acute pressure on the available finite supply of water because of the increasing demand from a rising population, pace of urbanization and processes of economic development.

On the demand side, it is required to make strenuous efforts for improving water use efficiency, demand restraint in management – reducing per capita allotment to moderate levels, and charging the ones using more, and multiple use of water including recycling.

The usable component of water available can be increased in three ways - Rainwater Harvesting, Ground Water Drilling and Large Dams, Reservoir Projects, or Long Distance Transfers. All the three yield results, and have their own impacts and consequences. It is required that all of them have to be used in the right combination of moderation. Large projects have larger consequences, and hence should be subject to stringent evaluation.



Mr. Ramaswamy Iyer, Former Secretary, Ministry of Water Resources and Honorary Research Professor, Centre for Policy Research, New Delhi making his speech at the Plenary Session





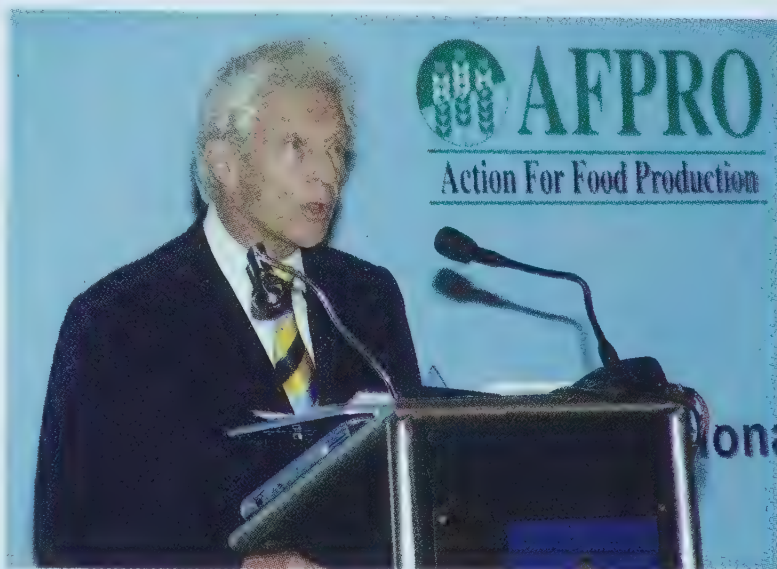
Dr. V. B. Kathiria, Member of Parliament, India



Dr. Hari. J. Krishna, Executive Vice-President, IRCSA

An ideal combination would be local augmentation through community led Water Harvesting and Watershed Development initiatives, as the primary thrust, and large projects – dams, reservoirs, as projects of last resort, chosen only when they are the unique option of the best available options. Ground Water exploitation has to be subject to stringent regulations for equity and resource conservation. It is also required to arrest and reverse the loss of good water to pollution and contamination. A major national, multi-pronged effort or movement including both the State and Civil Society is required.

**Dr. V. B. Kathiria**, Member of Parliament, India, accorded a very high level of importance to Rainwater Harvesting for improving local level prosperity. The socio-economic and ecological impact of Rainwater Harvesting was visible in an area in Saurashtra, Gujarat, where he had taken the initiative to establish a check dam, which had high impact on the quality of life of the people. He highlighted the issues of financial viability, sustainability and people's participation in the construction of check dams. Social reformers and religious leaders have a major role to play in promotion and implementation of Rainwater Harvesting, and have contributed in launching Rainwater Harvesting Schemes. Flexible



Mr. Ron Denham, Water Resource Task Force, Rotary International

planning, a mass movement and partnership by non-governmental organizations can help achieve the goal of providing water sufficiency, which is a key to prosperity.

**Dr. Hari J. Krishna**, spoke about Rainwater Harvesting as a key strategy in water

resource planning. In Texas, the state and the people have adopted an approach to water that comprises the five strategies of water conservation, rainwater harvesting, groundwater desalination, sea-water desalination and waste-water recycling. Harvested rainwater is even being bottled for sale in grocery shops. In fact, the government had taken an initiative to promote the cause by providing tax rebates. A similar localized integrated approach needs to be adopted everywhere.

**Mr. Ron Denham** highlighted the role of Rotarian in water sector. Rotary clubs in India and abroad have drilled number of water wells, constructed filters, check dams and water purification plants. Involvement of local community and their capacity building has been found to be useful in success of water related scheme. Empowerment of the community needs to be ensured for sustainability and success of water projects.

**Dr. B. R. Sharma** described the relevance of Rainwater Harvesting in the backdrop of recurring





Dr. B. R. Sharma, International Water Management Institute



Dr. Luiz Palmier, Federal University of Minas Gerais

droughts in Indian subcontinent, including India, Pakistan and Afghanistan. The impacts of droughts are serious and long lasting, affecting the economy and progress of the nation. The progress on drought preparedness has been slow. Therefore, the need for Rainwater Harvesting cannot be overemphasized. Rainwater Harvesting efforts in Rajasthan have provided much-needed water to the population, averting crises during dry seasons. There is need for a paradigm shift in water resource management and the traditional Rainwater Harvesting structure needs to be revived. Institutional planning, community involvement, demonstration of real life success stories are important factors in the successful implementation. Traditional technology needs to be integrated with recent innovations, and the best possible solutions and practices need to be propagated. The Master Plan for "Artificial Recharge to Groundwater" prepared by Central Groundwater Board is a valuable planning document for implementation. Hence, Rainwater Harvesting needs to be taken up in a mission mode for effective and widespread implementation.

**Dr. Luiz Palmier** provided a brief about the approach being adopted in Brazil for Rainwater Harvesting including challenges faced, programs and research



Dr. Terry Thomas, University of Warwick, IRCSA Board Member

being undertaken. A special feature is that participation by Civil Society and Government has been given much importance. There is also a slight shift in focus in the area of water, away from hydro-electricity generation towards water harvesting.

**Dr. Terry Thomas** while briefly explaining the

concept of Rainwater Harvesting appreciated the extant of the same in India, especially for the recharge of groundwater reservoirs.

Each Rainwater Harvesting solution is contextual, and depends on geographical, agro-climatic, hydro-geological and related features that vary across regions and countries, in their dimension and design. Hence, Rainwater Harvesting needs to be essentially discussed and implemented locally.

**Mr. Sompal** summarized the discussion and emphasized the need for civil society (community) to take initiative in water-related problems, especially for Rainwater Harvesting, and not to solely wait for government initiatives. Investment in minor irrigation will bring about benefits to people; and appropriate people centered community-based participatory watershed management offers a complete solution for sustainability of water resources.



# Salient Features of Technical Sessions

## THEME 1

### Rainwater Harvesting Structure and Technologies in Different Geo-Hydro-Thermo Regimes.

**Chairperson:** Dr. Saleem Romani, Chairman  
Central Ground Water Board

**Co-Chairperson:** Mr. Han Heijnen, WHO



1. The Tank Cascading System (TCS) is a technically feasible and popularly acceptable mechanism of Rainwater Harvesting in favorable agro-climatic and hydro-geological situations. This is an effective micro basin Rainwater Harvesting system for sustainable water management.
2. Human ingenuity to devise simple solutions using traditional acumen and indigenous technology for Rainwater Harvesting can be very effective in solving water scarcity problems in critical areas. The creation of sweet water pockets for Rainwater Harvesting by local inhabitants in the brackish hydro-geological environment of Kutch district in India's western State of Gujarat is a testimony to this.
3. An integrated water and land management policy, exemplified by the Brazilian example of 'one piece of land and two types of water programs', can be an important step for Mainstreaming Rainwater Harvesting. Land distribution through appropriate land reform, accompanied by the provision of water in a sustainable manner through suitable Rainwater Harvesting techniques, by involving the rural population in the planning and implementation process is an empowering combination.
4. Environmental Impact Assessment should be carried out to evaluate the water resource development projects in water scarce regions. For sustainable and effective water management in such regions, a broader integrated approach of rainwater harvesting from domestic rainwater harvesting in cisterns and micro-catchments to inter-basin transfer of water, needs to be adopted.
5. In hilly and plateau areas, even the least amount of rains can be effectively conserved through rainwater harvesting or soil and water conservation measures such as furrow and ridge planting, intercropping, contour bunding, etc. Even the use of an ordinary plastic sheet is effective to conserve moisture for seedlings.
6. Awareness of the potability of filtered rainwater in local communities is essential for Mainstreaming Rainwater Harvesting. For its acceptance, ease of handling and promotion, the community needs to be made aware of the technology and material utilized.
7. Effectiveness and productivity of Rainwater Harvesting techniques and conventional



water management practices can be further sharpened by incorporating historical water harvesting techniques and management practices, which were applied in different regions over millennia.

8. In Sri Lanka, the rainwater harvested through low capacity ferro-cement tanks of 5m<sup>3</sup> to 10m<sup>3</sup> volume is being used to supply water for paddy cultivation. Farmers also use the water for cultivation but also to generate additional income by brick making and other income generating options.
9. Measures such as the diversion of excess rainfall to nearby tanks, provision of vegetative cover on soil for facilitating recharge, desalination of brackish and saline water, reuse of waste water, implementation of dual water supply systems, etc. are all Rainwater Harvesting options that will help augment as well as improve ground water resources. •
10. While costing the water obtained through Rainwater Harvesting, the life of structures should also be considered, in addition to capital investment and other costs.
11. A specific approach of water harvesting and conservation needs to be adopted for hilly areas. Also, higher costs are incurred for

implementation in these areas; a fact that needs to be considered while costing and financing the projects.

## THEME 2

### Socio-Economic and Ecological Impact of Rainwater Harvesting: Issues of Financial Viability and Sustainability

**Chairperson:** Mr. G. N. Kathpalia,  
Alternative Futures India

**Co-Chairperson:** Ms. Tanuja Ariyananda,  
IRCSA, Sri Lanka

1. The direct impact of the check dam appears partial, but it is necessary to consider its indirect impact on stakeholders. It has been estimated that while direct impact is 60 percent, the indirect impact is 40 percent in the form of recharged groundwater and soil moisture.
2. Community participation at each stage of the program is essential for sustainable development.
3. Rainwater Harvesting in saline areas is useful for dilution of groundwater salinity.
4. It is important that sanitation be integrated with Rainwater Harvesting in order that contamination of groundwater and water quality deterioration may be avoided.
5. Formalized village level institutions are essential for implementation of Rainwater Harvesting programs.
6. Rainwater harvested for drinking purposes should be checked for quality and applied treatment accordingly.
7. Community-based water harvesting structures are very sustainable and adoptable in rural areas.
8. Groundwater is being increasingly used for irrigation causing the rapid depletion of water table. The construction of buildings, pavements, etc. has reduced the natural recharge to ground. Hence, Rainwater Harvesting for collection and recharge is very essential.







9. Sub-basin level water balance studies are necessary for effective planning of Rainwater Harvesting schemes.
10. Rainwater Harvesting needs to be linked with wasteland development for promoting sustainable rural livelihoods.
11. In order to create models of sustainable wasteland development addressing the issue of equity, an integrated effort is required at the local levels. Local governments, voluntary organizations, academic institutions, scientific community, village level institutions and marginalized sections need to coordinate for the same.
12. Water literacy is an important part of Mainstreaming Rainwater Harvesting. All sections of the society, including schools, need to be addressed under this component.
13. Watershed Management is an integrated approach, which if implemented with high level of people's participation, results in maximum returns in terms of ecological and socio-economic sustainability.
14. A proper know-how about maintenance and management of Rainwater Harvesting schemes is required at the community level.
15. The construction of cascaded check dams has shown substantial rise in water levels.
16. A partial contribution by the community is essential to create a sense of ownership within the community and thus ensure sustainability of the systems.
17. Rainwater Harvesting in buildings not only addresses localized storm water problems but also provides potable water, reducing the demand from external sources.
18. Integrated rainfed farming with on-farm reservoirs and ponds have proved to be appropriate and cost effective in eastern India.
19. Mass communication, capacity building and establishment of community institutions are effective in changing the attitude of communities towards water conservation measures.



## THEME 3

**Water Laws and Policy: Problems, Prospects and Consumer Perspective in Rainwater Harvesting and Management of Groundwater**

**Chairperson:** Dr. Bindeshwar Pathak,  
Sulabh International

**Co-Chairperson:** Mr. Paul Deverill,  
UNICEF

1. The prevailing policy and legal initiative, at best provides a piece meal approach to Rainwater Harvesting. This will not eliminate the colonial approach to Natural Resource Management. Hence, there is a need to bring in fundamental reform in policy and law.
2. The emerging globalized market economy, that has direct impact on natural resources, can pose a threat to decentralized, participatory, sustainable management of natural resources.
3. Water resource augmentation and demand management measures, including legislations or regulations required, should be an integral part of the strategy adopted for water resource management. However, the success of these measures depends on their acceptance by the population affected by them. In order to ensure

this, it is essential to consult stakeholders, consumers and poor and vulnerable sections of the community beforehand and devise effective equitable plans.

4. Rainwater Harvesting needs to be encouraged at domestic, neighborhood and institutional levels, both through persuasive and legal measures. Provisions for Rooftop Rainwater Harvesting must be made mandatory under law at the time of construction itself. Incentives for installation of the same should also be provided by way of rebate in taxes such as property tax.
5. Residential irrigation demands in urban areas can be managed through efficient water use and designing water-wise gardens. Rainwater tanks are cost effective options for water supply in 'Green fields' developed in urban areas.
6. Rainwater tanks, apart from providing an additional source of water, also have the potential for flood control and improve the water quality.
7. Rainwater Harvesting is an economical engineering solution for tackling problems both of water scarcity and floods, and also to meet the requirement of water for irrigation. Interlinking of Indian rivers may disturb hydrological balance besides so many other harmful effects. However, a balanced combination of river linking and Rainwater Harvesting could be effective in solving the water crisis.
8. Water should be treated as a consumer good.
9. Effective awareness and capacity building activities need to be undertaken in order to increase levels of participation and social acceptance.
10. Soft loans should be provided to small and marginal families in urban and rural areas, for implementing Rainwater Harvesting structures.
11. Ownership problems regarding recharged groundwater, which is a common pool resource, needs to be tackled at the local level by the community or by water user associations.







#### THEME 4

##### **Framework for Mainstreaming Rainwater Harvesting and Management in Rural, Urban and Industrial Sectors**

**Chairperson:** Mr. D. K. Manavalan,  
Executive Director, AFPRO

**Co-Chairperson:** Dr. Hari Krishna,  
Executive Vice-President,  
IRCSA

1. NGOs have proven the viability of Rainwater Harvesting starting with small projects that grew bigger and became significant (Ugandan experience).
2. In Uganda, women's groups have formed federations to strengthen their voice for influencing politicians and negotiating with government administration regarding the consideration of Rainwater Harvesting as a viable option for water supply.
3. Rainwater Harvesting is an effective option for supplementing traditional water supply systems in rural settings that require women to fetch water from distant water sources. Not only does it provide water at the village or at the doorstep, but also many additional benefits such as better health of women and children, social tranquility,

and time for income-generation and creative activities.

4. Rainwater centers need to be set up in all countries in order to spread awareness on Rainwater Harvesting through campaigns for making it a mass movement.
5. An International Rain Center could be set up with the help of United Nations Environmental Program (UNEP); and a National Rain Center in India, with the help of the Ministry of Water Resources, Government of India.
6. Rainwater Harvesting, while important in every major town and city world over, has special importance and necessity in coastal cities.
7. Rainwater Harvesting projects, especially in rural areas, can be well implemented by NGOs. The participatory approach used by NGOs in project implementation and management ensures sustainability of the project, as communities are empowered with skills that enable them to continue without external intervention.
8. Subsidized Rainwater Harvesting systems are a good approach, as they take care of the socio-economic status of rural communities.
9. Domestic Rooftop Rainwater Harvesting is a user-friendly water supply option in water stressed areas, which reduces water borne





diseases, and is easy to manage and maintain because of individual ownership.

10. Traditional water conservation practices termed as Homestead Watershed Management (HWM) are practicable in the State of Kerala in India, where rainwater is conserved and used for groundwater recharge, using vegetative fences and coconut leaves in the premises of households.
11. Media needs to be sensitized to play an important role in propagating Rainwater Harvesting. Besides coverage of drought and water scarcity stories, which carry a negative impact, stories of sustainable solutions through Rainwater Harvesting need to be highlighted regularly. Water journalists, similar to sports or crime correspondents, need to be groomed to suitably tackle water related concerns and solutions.
12. It is possible to determine the optimum capacity of tank size required to store rooftop runoff for irrigating home gardens. Studies in Sri Lanka reveal that 11 times the roof area can be cultivated using the rooftop runoff harvested.
13. Traditional methods and modern techniques can be combined to recharge groundwater for optimal utilization of rainwater.
14. Combination of Rainwater Harvesting, supplemental irrigation and conventional dry



farming practices can significantly increase water use efficiency; which if expressed in terms of cash is ten times more efficient than old practices (Chinese example).

15. Rooftop Rainwater Harvesting should not be a temporary measure, but should be integrated in the strategy of poverty alleviation.
16. There is need for standardization and calibration of the efficiency and contribution of water harvesting structures in various agro-ecological and agro-climatic regions. Research needed for this purpose should be promoted.
17. Selection of a suitable water harvesting structure should be based on the hydro-geological and meteorological conditions. Guidelines should be developed for large-scale implementation of government projects, to be facilitated through community-based institutions.
18. Participatory community management is an effective way of sustainable groundwater management. However, enabling policies to complement peoples efforts are a must.
19. The barriers to mainstreaming are ignorance, absence of a supply chain, and lack of training and demonstration.







20. Efforts at Mainstreaming Rainwater Harvesting should pay more attention to commercial participation than at present.

## THEME 5

### Rainwater Quality, Sanitation and Hygiene Aspects

**Chairperson:** Mr. Richard Jennings,  
Earth Wrights Design,  
New Mexico, USA

**Co-chairperson:** Dr. Luiz Palmier, Federal  
University of Minas Gerais Brazil

1. Stored rainwater needs to be regularly monitored for its chemical quality and bacteriological contents. Studies indicate presence of biofilms in rainwater tanks created by environmental bacteria such as *Bacillus* Spp. Demonstration projects revealed that domestic hot water services set at temperature greater than 52 degree centigrade consistently eliminate bacteria from rainwater.
2. Hygienic water purification measures are needed either at source or during the process of collection, handling, storage and use. Basic treatment of water and hygiene education must be included in water supply and sanitation projects.

3. The settlement of suspended matter to the bottom of storage tank is one of the beneficial aspects of Rainwater Harvesting.
4. Water safety kits are useful tools, which can be provided to schools for chemical and biological analysis of rainwater.
5. Rainwater is comparatively safer than public water supply, especially from the risk of gastroenteritis.
6. It has been found that water catchment projects implemented and managed by the community have proved successful in providing clean and safe water.
7. Proper designing and maintenance of rooftop rainwater harvesting systems is essential to ensure good quality of water.
8. Areas having high concentrations of minerals in groundwater stand to benefit significantly from Rainwater Harvesting, as it will help to improve health standards and reduce the incidence of diseases caused due to high content of calcium, arsenic etc.
9. There is no standard yet for quantifying the first flush diversion. Based on studies the following thumb rule has been suggested - "For each mm of first flush, the contaminate load will halve".







## THEME 6

### Technological Aids for Rainwater Harvesting

**Chairperson:** Dr. Terry Thomas,  
Warwick University, U.K.

**Co-chairperson:** Dr. S. K. Sharma,  
Former Member,  
Central Ground Water Board

1. Remote sensing and GIS techniques are cost-effective, time-effective and very accurate in identifying suitable sites for water harvesting.

2. Satellite remote sensing data can be used to study the impact of water harvesting/water management practices that have been implemented in a watershed.
3. Spatial decision support systems developed by amalgamation of remote sensing and GIS techniques can be used for periodical verification and modification of watershed management schemes.
4. Two measures of Rainwater Harvesting, i.e. gradually constructed contours, and contour ridge and furrow planting can increase soil moisture. This will reduce soil erosion as well as lead to increased crop production, and is very effective in micro-catchments.
5. Low-cost self-cleaning inlet cloth filters are effective filtration mechanisms for reducing contaminants in water storage units.
6. From these initial tests it is clear that simple cloth filters can be made with high effectiveness and hydraulic efficiency characteristics. Self cleaning by introducing a sloped side appears to work. These encouraging results coupled with cloth's availability, low-cost and ease of cleaning make cloth filters very attractive for use in low-cost roofwater harvesting systems.





## Role of School Children in Mainstreaming Rainwater Harvesting

In order to highlight the role of school children in promoting Rainwater Harvesting, a special session sponsored by UNICEF was conducted on the second day of the Conference. 6 school children and their teachers from three different schools of India, made presentations on real-life Rainwater Harvesting.

This was to convey the message that Rainwater Harvesting needs to be included in school-level education, in order to prepare these young people for the uncertain future of water. These children are also terrific ambassadors of Rainwater Harvesting. In addition, in the peak of summer or other periods of water shortage, children suffer a lot.

These schools represented a cross-section of India with different socio-cultural backgrounds and varied geo-hydro thermo regimes, and gave the

delegates a foretaste of the backdrop in which Rainwater Harvesting has to be mainstreamed. The following is a brief of the presentations.

### Government Primary School, Pachevar, Tonk District, Rajasthan

The State of Rajasthan, that faces perennial drinking water problems, is characterized by scanty rainfall and groundwater laced with fluoride and high salinity. UNICEF took the initiative to make a Rainwater Harvesting structure of 80,000 litres capacity in Government Primary School, Pachevar, Tonk District, Rajasthan. Now, not only does the school have enough water for drinking and sanitation, but it is also able to provide water to the village during vacations.





### Baker Memorial Girls Higher Secondary School, Kottayam District, Kerala

Kerala, even with its luxuriant rainfall, faces water scarcity in summer. Non-availability of water in schools results in reducing the daily water intake of drinking water by children, and also prevents basic sanitary practices. This has a direct impact on the students in terms of health deterioration and poor performance.

The Rainwater Harvesting structure that serves Baker Memorial Girls Higher Secondary School, Kottayam District, Kerala, stores 35000 liters of rainwater and has brought a perceptible change in the habits, health and performance of the students. Many people now visit the school to observe this structure, and some have even replicated it at their residences. Due to the success of the structure in the school, 29 other schools have implemented Rainwater Harvesting schemes in their campuses.

### Panchayat Union Primary School, Kavindapady, South Erode District, Tamil Nadu

Tamil Nadu suffers from low rainfall and unfavorable hydrogeological conditions due to prevalence of hard rocks. Wells dry up and are unable to serve as sustainable sources of drinking water. UNICEF has supported the construction of a Rainwater Harvesting structure having storage capacity of 100000 liters in Panchayat Union Primary School, Kavindapady, South Erode District, Tamil Nadu. This has provided the much-needed source of water for drinking and sanitation.

**The enthusiasm** of the school children and their forceful narration of the benefits of Rainwater Harvesting added a unique dimension to the conference. They raised the slogan "Jal hai to Kal hai" meaning - "If there is Water, there is Tomorrow". They also demonstrated a 'Rain-Clap', requiring synchronized participation by the delegates.



*Little ambassadors of Rainwater Harvesting at their enthusiastic best*



## Technical Field Visits and Exhibition



### Technical Field Visit

The delegates visited rainwater harvesting facilities installed and operated by the Government, Corporate and Voluntary Non-Government organizations, viz.

- Rainwater Harvesting Structures facilitated by Central Ground Water Board at IIT-Delhi, Jawaharlal Nehru University, Indian Airlines Office, Lodhi Garden and AIIMS Flyover.
- International Development Enterprises (IDEI) Brijwasan and ITC Green Centre, Gurgaon.
- Integrated Water Management Facility in villages of Mewat Region of Haryana - Sehgal Foundation.

The field visit gave an exposure to varied techniques of Rainwater Harvesting implemented in different Geo-Hydro-Thermo regimes with government, private and voluntary organizations intervention.

In the feedback sessions, the delegates were unanimous in their appreciation of the efforts of these agencies. They also deliberated on the technology as well as the financial implications of undertaking similar projects, along with future operations and maintenance requirements.



**Top:** Check dam by Sehgal Foundation, **Middle:** Low cost drip irrigation system demonstrated by IDE(I) **Bottom Left:** Rainwater Harvesting structure implemented by Central Ground Water Board at Lodi Gardens, New Delhi **Bottom Right:** The ITC Green Center



## Exhibition on Rainwater Harvesting during IRCSA 2005

The Exhibition at the Conference gave a variety of organizations the opportunity to portray their efforts, technology and products in the field of Rainwater Harvesting. Bal Bhavan - Jaipur, GVNML - Jaipur, GIS Development - New Delhi, ION Exchange - New Delhi, ITC - Bhopal, People for Rainwater - Japan, Sehgal Foundation - Gurgaon, SPWD - New Delhi, UNICEF - Jaipur, VIKSAT - Ahmedabad, WESNet - New Delhi and AFPRO participated in the Exhibition. Thus, the delegates were presented with a panorama of site specific Rainwater Harvesting models constructed in different geo-hydro-thermo regimes and backgrounds. Among the features were an audio-visual display of experiences from the field, films on Rainwater Harvesting, awareness creation by children on water conservation measures, methodologies adopted for Rainwater Harvesting, equipments related to water quality, and publications.

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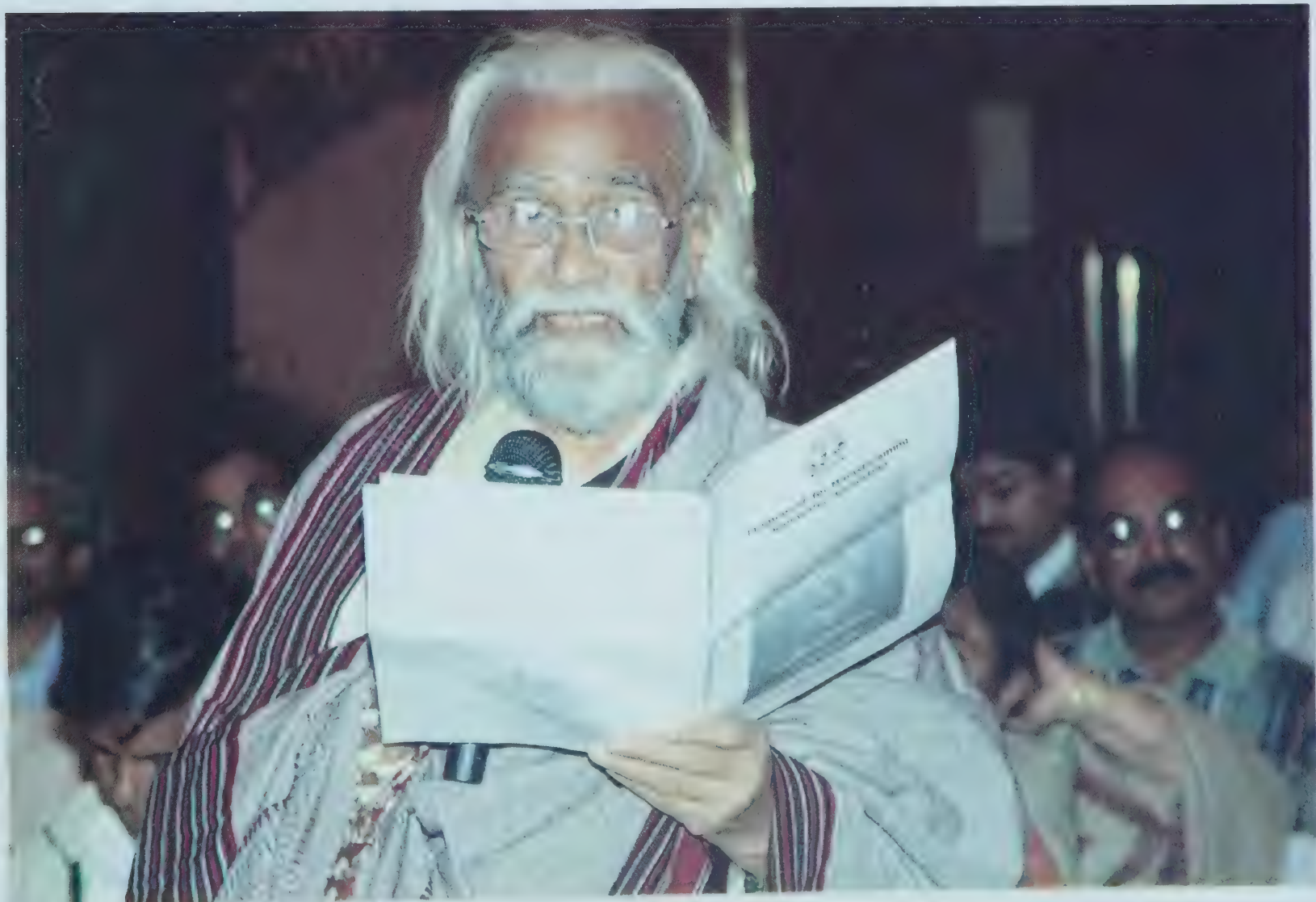




## Conference Recommendations

**B**ased on the discussions and the draft framework circulated, the XII International Rainwater Catchment Systems Conference put forward the following recommendations for Mainstreaming Rainwater Harvesting.

1. The world and its people are at the verge of a water scarcity situation. It is now universally recognized that water is one of the most vital commodities and its scarcity tends to threaten the very survival of life on all its forms on earth. The water scarcity has already become a factor depressing living standard of population in many parts of the world. It has major implications for weaker sections of society especially women in the present situation. Access to safe drinking water is still a distant dream.
2. Rainwater is a resource utilized by the community in both rural and urban areas. Approaches to be employed in rural and those in urban areas may differ vastly despite common features being present.
3. Mainstreaming of Rainwater Harvesting is the need of the hour in total water management and should become a movement to embrace participatory water management, sector reform, institution building, capacity development and women's empowerment. Rainwater Harvesting should be firmly embedded in a demand



*A delegate raises a point during the session on Framework for Rainwater Harvesting*



- management solution for sustainable water supply for both rural and urban areas.
4. Rainwater is an integral part of all the resources management and should be included in all policies, especially the water policy, programs and projects of development management, supply and conservation of water.
5. Women as primary collector and manager of water of household level are the focal point of Rainwater Harvesting schemes and their participation should be integral in the policy, management and intervention levels of Rainwater Harvesting and water supply, Rainwater Harvesting Capacity building program needs to be facilitated through specific campaign to overcome traditional gender bias.
6. All the stakeholders including government, local institutions, communities, technical experts, women and NGO's should be involved in designing, implementing, operating, maintaining and monitoring Rainwater Harvesting schemes with a view to providing solutions for sustainable water supply.
7. Site-specific sound technical input for designing and implementing Rainwater Harvesting is essential for its success; service of technical experts should be part of the total process.
8. Watershed, basin and hydrogeologically contiguous groundwater reservoirs (Aquifers) are key areas to manage Rainwater Harvesting in a technically appropriate way. A database needs to be prepared encompassing all required technical inputs, made secure, permanent and reviewed/updated regularly.
9. Rainwater Harvesting is an important part of source control to mitigate floods locally and surcharging of rainwater drains, which should be built into the planning process.
10. The link between sensitive ecological zones and rainwater is critical and the interface has to be managed correctly.
11. It is essential to properly manage and monitor the Rainwater Harvesting by the beneficiaries and observe the benefits to replicate or improve design and to remove negative impacts. Monitoring of water quality of Rainwater Harvesting and its remediation is to be accorded priority. Committee should be set up amongst beneficiaries along with experts to monitor the performance and benefits of the Rainwater Harvesting, Committees of beneficiaries should also play the role of local regulatory authority for equitable distribution of water from Rainwater Harvesting.
12. Government and Non-Government bodies (private sector) should play a proactive role of basic initiator; and beneficiaries should contribute equitably for generating a sense of ownership. Bankable schemes with financial support from institutional financial agencies need to be prepared and banks need to play a role of facilitator.
13. Industries have a special role to play in promoting and financing Rainwater Harvesting as they are not only one of the major water consumers but also responsible for water quality deterioration through industrial effluents affecting the health of inhabitants. Installation of Rainwater Harvesting in industrial complexes, and recycling of used water be made mandatory to minimize water needs.
14. Rainwater Harvesting should be used as an entry tool for developing overall water literacy. Training of stakeholders, including training of trainers should be regularly arranged through institutions and NGOs. The government should also play an active role in training.
15. Media – both print and electronic, need to play a proactive role in popularization of Rainwater Harvesting. Water Journalists need to be groomed like those in sports and crime to enlighten the readers about water-related issues.



## Valedictory Session

The valedictory session was presided over by Mrs. Sheila Dikshit, Hon'ble Chief Minister, Delhi. The others present on the dais included Dr. Jessica C. Salas, President IRCSA; Fr. John Noronha, Vice President, AFPRO and Executive Director, CARITAS India; Mr. D. K. Manavalan, Executive Director, AFPRO; Dr. Hari J. Krishna, Executive Vice-President IRCSA; Mr. Ram Krishnan, Director, Akash Ganga Trust; and Mr. R. K. Pandey, Program Coordinator, AFPRO.

Conference Recommendations were put up before the delegates for final adoption. They were unanimously adopted and handed over to the Chief Guest, Mrs. Sheila Dikshit.

The venue of the XIII International Rainwater Catchment Systems Conference to be held in 2007 was announced as Australia.

**Mrs. Sheila Dikshit**, Hon'ble Chief Minister of Delhi, delivering the valedictory address complimented the organizer for arranging this conference on this very topical and important issue. She spoke on the widespread need of an attitudinal change towards water. People need to inculcate the habit of judiciously using and conserving water. The depleting groundwater levels the world over pose a tremendous challenge, and replenishment through suitable Rainwater Harvesting measures is a must.

Water management modules being practiced today need a lot of improvement. Consistent efforts need to be made in the direction of monitoring and management of water used on a daily basis in the city. Flushing systems of the city, too, need to be modernized. Delhi, being an ancient city, has water distribution systems deeply embedded underground; however, there are no means to trace and repair these, which results in a huge loss of water.

In order to protect water from wasteful or inordinate use, Mrs. Dikshit was of the view that there should be a price attached to water use; and the one who uses more should pay more. An attitude of careful use of water would not be cultivated unless those using it would be charged in proportion to usage.

People should react warmly to the concept of Rainwater Harvesting. Even if Rainwater Harvesting is made mandatory under the Law, it may not receive widespread acceptance because of the costs involved. It is up to the people to adopt this technology as part of their daily lives.

People are also suspicious of using recycled water. There is thus a need for creating awareness amongst the people on all aspects related to water harvesting, conservation and usage.

**Mr R. K. Pandey**, brought the conference to a conclusion, and acknowledged the efforts of all who participated and worked for the conference.



Mrs. Sheila Dikshit, Hon'ble Chief Minister, Delhi, addressing the delegates



## Media Coverage

The media - both print and electronic, showed keen interest in covering the XII International conference of IRCSA. They focused on issues of water shortage and the importance of Rainwater Harvesting. The media showed its concern for the issues about the future of water resources in India and the need to tackle these. Certain sections of media were interested in the solutions at a larger level and the need to create awareness amongst the general public for rainwater harvesting.

The events of four days conference were reflected in different newspapers at National and Regional level. These included the Hindustan Times, The Times of India, The Hindu, The Tribune, The Indian Express,

The Asian Age, National Herald, The Pioneer, The Statesman, Rashtriya Sahara, Veer Arjun, Dainik Bhaskar, Malayalam Manorama, Amar Ujala, Dainik Jagran, Mahamedha, Mid-day, Jansatta, Rajasthan Patrika, and Punjab Kesri. The National television channel Doordarshan showed a special footage of inaugural session and UNICEF sponsored children's session.

Besides this, reports of conference proceedings, and interviews of dignitaries and delegates attending conference, were posted on the websites like [www.peoplesdailyonline.com](http://www.peoplesdailyonline.com), Xinhua China, [www.indianNGOs.com](http://www.indianNGOs.com), [www.newkerala.com](http://www.newkerala.com), and [www.webindia123.com](http://www.webindia123.com).





# Conference Program

## Day 1 Tuesday, November 15, 2005

08.30 – 09.30	Registration
09.30 – 10.45	Inaugural Session
10.45 – 11.15	Tea Break
11.15 – 13.00	Plenary Session
13.00 – 14.00	Lunch Break
14.00 – 15.30	Technical Sessions: Theme 1, 2 and 4
15.30 – 16.00	Tea Break
16.00 – 17.30	Technical Sessions: Theme 1, 2 and 4
19.00 – 22.00	Inaugural Dinner at Daffodil Hotel, New Delhi

## Day 2 Wednesday, November 16, 2005

09.00 – 10.10	Technical Sessions: Theme 1, 2 and 4
10.10 – 10.30	Tea Break
10.30 – 13.30	Technical Sessions: Theme 3, 5 and 6
13.30 – 14.30	Lunch
14.30 – 16.00	Wise Water Management – A Critical Role of Children in India - UNICEF
16.00 – 16.30	Tea Break
16.30 – 17.30	Framework for Mainstreaming Rainwater Harvesting in Rural/Urban Areas & Poster Presentation

## Day 3 Thursday, November 17, 2005

08.30 – 18.00	Technical Field Visits
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## Day 4 Friday, November 18, 2005

09.30 – 10.30	Feedback on Technical Sessions/Field Visits
10.30 – 11.00	Tea Break
11.00 – 12.30	Finalizing Recommendations for Mainstreaming Rainwater Harvesting
12.30 – 14.00	Lunch Break
14.00 – 15.30	Special Sessions
15.30 – 16.00	Tea Break
16.00 – 17.00	Valedictory Session



# Papers Presented

## THEME 1

### Rainwater Harvesting Structures and Technologies in Different Geo-Hydro-Thermo Regimes

1. Rainwater Harvest by Tank Cascades in Sri Lanka: Was it a Technically Adapted Methodology of the Ancients?  
– Gangadhara, K.R. and Jayasena, H.A.H.
2. Sweet Water Harvesting in Brackish Formations using Traditional Wisdom - A case study.  
– R.K. Pandey and Sunil Simon
3. International Centre for Demonstration and Training on Efficient Use of Rainwater Harvesting (CIDECALLI)  
– Garduno Manuel Anaya
4. Towards an Improvement of Water Management in Regions of Water Scarcity.  
– Luiz Rafael Palmier
5. P 1+2: Rainwater Harvesting Program for Livestock and Agriculture in the Brazilian Semi-Arid Tropic.  
– Johann Gnadlinger
6. Effects of Different Rain Harvest Methods in the Hilly Area of the Northern Loess Plateau.  
– Zheng Dawei, Duan Yu, Tuo Debao, Wang Yantian, Zhang Jianxin
7. Rooftop Rainwater Harvesting System in Deccan Plateau Regions of Andhra Pradesh.  
– R. Amarnath Babu
8. Traditional Water Harvesting in Anatolia and Water Harvesting Prospects for Turkey.  
– Hamza Ozguler
9. Rainwater Harvesting Structures and Technologies in Different Geo-hydro-thermo Regimes in Agro-climatic Zones - A Case Study  
– K.R. Sivaraman

10. Rainwater Harvesting for Home Gardens in Dry Zone of Sri Lanka.

*P.A. Weeransinghe, T.N. Ariyananda, C.S. Weeraratna*

11. Water Management in Jammu Shivaliks.

*Maj. Gen. G.S. Jamwal*

## THEME 2

### Socio-Economic and Ecological Impact of Rainwater Harvesting: Issues of Financial Viability and Sustainability

1. Indirect Economic Impacts of Rainwater Harvesting Structures - Case Study of Check Dams in a Village in Shivalik Hills Region, India.  
– R P S Malik and Meera Bhatia
2. An Integrated Sustainable Rural Water Management Model and Its Replication.  
– Lalit Sharma and Ellora
3. Rainwater Harvesting: Impact on Society, Economy and Ecology.  
– Radha Goyal and Bharat Bhushan
4. The Role of Rainwater Harvesting in Wastelands Development: Ecology, Sustainability & Equity Issues.  
– Hardeep Singh and Amita Bhaduri
5. Drinking Water Source Sustainability and Improvement in Groundwater Quality in Rural Gujarat.  
– Indira Khurana
6. Rainwater Harvesting in the UK- A Solution to increasing Water Shortages?  
– Cath Hassell
7. Need for Groundwater Utilisation and Management in Aurangabad City, Maharashtra.  
– S M Deshpandey
8. Economics of Rainwater Harvesting in the On-farm Reservoir for Integrated Rainfed Farming System in Eastern India.  
– Lakshmi Narayan Sethi, S. N. Panda and L. P. Pholane



### THEME 3

#### Water Laws and Policy : Problems, Prospects and Consumer Perspective in Rainwater Harvesting and Management of Groundwater.

- 1 Political Economy of Rainwater Harvesting in India : Reflections on Central And Regional Law & Policy.  
– M.S. Vani
- 2 Rainwater Harvesting for Residential Irrigation: How Sustainable is it in Urban Context?  
– Bhakti Lata Devi, Basant Maheshwari and Bruce Simmons
- 3 River Interlinking and Rainwater Harvesting: A comparison in Indian perspective.  
– Devendra Mohan & S. Sarkar
- 4 Integrated Water Resource Strategies.  
– David B. Stacey, Elizabeth Mann and John Petrie
- 5 Consumer Perspective in Water Management and its Relevance to Rainwater Harvesting.  
– Bejon Mishra
- 6 Innovative Policy Interventions to Increase Domestic Rainwater Harvesting in Urban Areas.  
– Tejwant Singh Brar, R.K. Jain and Deepak Khare
- 7 Rainwater Harvesting and Artificial Recharge to Groundwater - A Sustainable Vision for Future.  
– D. K. Chakravarti
- 8 Promoting Rainwater Harvesting Practices in an Urban Context - Impact on Society, Economy and Ecology: Bangalore, India - A Case Study.  
– S. Vishwanath

### THEME 4

#### Framework for Mainstreaming Rainwater Harvesting and Management in Rural, Urban and Industrial Sectors

- 1 Women Groups Harvest Rainwater and Influence National Policy: A Ugandan Case Study  
– Charles Rwabambari, Hans Hartung
- 2 The Role of Rain Centres in Promoting Rainwater Harvesting in Urban Areas.  
– Sekar Raghavan

3. Piloting the Delivery of Domestic Roof Water Harvesting Systems in Bushenyl and Mbarara Districts in Western Uganda.  
– Grace Nakanjakko and Gloria Kamugasha Karungi
4. Rainwater Harvesting Proposals for Guadalajara.  
– José Arturo Gleason
5. Using Media to Popularize Rainwater Harvesting - Our Experiences.  
– Shree Padre
6. Community Management of Groundwater Resources in Rural India.  
– Roger Calow, David Macdonald, Himanshu Kulkarni, Marcus Moench, Srinivas Mudrakartha, Alan Nicol, M.S. Rathore and K.Palanisami
7. Optimum Tank Capacity for Rainwater Harvesting System in Home Gardens.  
– Champa Navaratne, K.D.N. Weerasinghe and L.N.N. Jayasuriya
8. Rain Water Harvesting is the way to enhance water use efficiency in rainfed area.  
– Zhu Qiang. And Li Yuanhong
9. Augmenting Groundwater Resources through Artificial Recharge - AGRAR Experiences, India.  
– Srinivas Mudrakartha
- 14 Mainstreaming Rainwater Harvesting: Uganda Experiences.  
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#### Rainwater Quality, Sanitation and Hygiene Aspects

1. Research Findings on Toxoplasmosis: A Case Study on Rooftop Rainwater Catchments in the Maldives.  
– Samuel Godfrey
2. Rainwater Harvesting Systems: An Integrated Approach for the Provision of Safe Water from Cisterns.  
– Richard Jennings
3. Recommendation for Improving Rainwater Quality.  
– Tanuja Ariyananda
4. Community Catchments in Southwestern Uganda.  
– Geoff Owen
5. Quantifying the First Flush Phenomenon  
– D. Brett Martinson, Terry Thomas



## THEME 6

### Technological Aids for Rainwater Harvesting

6. Dhaka Community Hospital's Experience With Rainwater Harvesting  
– *Mahmuder Rehman*
7. Tank Sludge as a Sink for Bacterial and Heavy Metal Contaminants and its Capacity for Re-suspension, Settlement and Flocculation Enhancement.  
– *Anthony T. Spinks, B. Berghout, R.H. Dunstan, P.Coombes, and G. Kuczera*
8. Slow Sand Filtration within Rainwater Tanks  
– *Celia Way and Terry Thomas*
9. Consumption of Tank Rainwater and Influence of Recent Rainfall on the Risk of Gastroenteritis among Young Children in Rural South Australia.  
– *Jane Heyworth*
10. Rainwater Harvesting and Health Risks: Preliminary WHO Guidance.  
– *Han Heijnen*
11. Comparison of Two Water Conservation Measures - Preliminary Findings in Jhabua District (MP).  
– *Samuel Godfrey*
12. Sustainable Moisture Management - Its All Water: Its All Good  
– *Richard Jennings*

1. Water Resources Development - Role of Remote Sensing and GIS.  
– *KHV Durga Rao & P.S.Roy*
2. Application of Remote Sensing and GIS in Groundwater Prospective Mapping and Siting Recharge Structures.  
– *Anand Kumar*
3. On Deriving a General Operating Policy of a Multiple Reservoir System using a Combination Model of Optimization and Artificial Intelligence Techniques - A Case Study in the Mae Klong System, Thailand.  
– *Janejira Tospornsampan and Ichiro Kita*
4. Two Within -field Rainwater Harvesting Measures and their Effects on Increasing Soil Moisture and Crop Production in North China.  
– *Jianxin Zhang, Dewei Zheng, Wang Yantian, Duan Yu and Yanhua Su*
5. Low -Cost Inlet Filters for Rainwater Tanks.  
– *D.Brett Martinson, Terry Thomas*



# Framework for Mainstreaming Rainwater Harvesting

A draft Framework for Mainstreaming Rainwater Harvesting was circulated among the delegates for discussions. Three sessions of the conference were devoted to these deliberations, before arriving at the final conference recommendations. The framework is presented here.

## Preamble

It is now universally recognized that water is one of the most vital commodities and its scarcity tends to threaten the very survival of life in all its forms on earth. None of the scenarios projected for the 21<sup>st</sup> Century presents a rosy picture of water availability. Besides, water scarcity has major implications for weaker sections of the society, especially women. The need for demand-supply management and conservation of water resources while ensuring environmental protection stands out as the crux of all solutions, with Rainwater Harvesting occupying center stage. Yet, the efforts made in this direction have barely touched the fringes, and Rainwater Harvesting remains a mere slogan, only practiced in a few scattered localities. Recognizing the need for making Rainwater Harvesting a mainstream activity for all communities in rural and urban areas, and all sectors of economy, the XII International Rainwater Catchment System Conference, 2005 presents a framework for the purpose.

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	RURAL AREAS	URBAN AREAS
<b>General</b>		
Community Management	This is the key to success at water related projects. Each individual in every community is a stakeholder.	
Awareness Education	All the means of educating the people, such as audio-visual media, street plays, success stories on Rainwater Harvesting, personal contacts, group discussions, field visits to model areas, seminars and workshops etc. may be employed as appropriate. Stakeholders must be made aware of the problems and potential of Rainwater Harvesting in ameliorating water scarcity.	
Approach	Approaches to be employed in rural areas and those in urban-industrial conglomerates may differ vastly despite common features being present.	
Priority	Clean water for drinking and domestic purpose gets priority in all cases.	
Community	Predominance of primary sector of economy viz. agriculture and related activities, which are major consumers of water.	Predominance of secondary and tertiary sectors



	RURAL AREAS	URBAN AREAS
	Generally an identifiable and comparatively cohesive body, which can be brought together with greater ease.	More amorphous and individualistic. It needs to be brought together on a common platform. Non-government organizations and social mobilizers can be effective in motivating the urban community.
	Public participation is influenced by local politics, sectoral interests and social setup.	
	Community-based organizations to take the lead in implementing Rainwater Harvesting.	Organized groups like Residents' Welfare Association can take the lead in implementing Rainwater Harvesting
Variety of Structures	Rural geography and environment permit a great variety of Rainwater Harvesting structures.	Dense population, industrialization and rampant pollution, permit limited and specific Rainwater Harvesting structures.
Applicability of Technical Concepts	Concepts of planning and implementation on watershed basis are practicable in rural areas.	Concepts of planning and implementation on watershed basis need to be modified in urban areas. City master plans should include water use plans with especial emphasis on Rainwater Harvesting.
Expertise and Skill for Technical Investigation and Installation	Not readily accessible.	More accessible.
Problems on Account of Presence of Industry	Industrial activities have major impact on environment and water resources. Being major consumer of water, draw large share of surface water or install deep wells with high capacity of pumps to withdraw groundwater resulting in adverse impact on existing facilities of water for local inhabitants.  Industrial effluents deteriorate water quality of the area directly affecting the health of nearby inhabitants.	
Strategy		
Key Players		
The Poor	To be treated as net resource replete with their own ideas and experience, well in tune with local conditions, and should form an integral part of Rainwater Harvesting	
Women	The primary collector and manager of water at household level has to be closely involved	
Local Bodies	Local Governments, Institutions (including Hospitals, Academic institutions), Non-governmental organizations, Industries, Industrial houses can play a primary role in motivating, organizing, designing and monitoring Rainwater Harvesting	
Technical Expertise	Services of experts, such as Hydrogeologists, Civil Engineers should be utilized along with local/traditional expertise in rural areas, in planning, designing and implementation of efficient and cost effective Rainwater Harvesting structures	



	RURAL AREAS	URBAN AREAS
<b>Database</b>		
Geology and Topography	Local geography, geological set up and terrain specific topographical details, maps showing contours, and land use pattern etc. should be prepared. Modern tools, including GIS, should be used.	
Climatic Details	Rainfall pattern, intensity, dry days, temperature range etc.	
Catchment Area	Household and Institutional buildings, paved areas, road, flyovers, etc.	
Water Availability	Surplus, non-committed monsoon runoff for groundwater recharge; details of rivers, streams, canals.	
Water Source Inventory	Inventory of all water sources including groundwater.	
Ground Water Conditions	Hydrogeological set up, depth to water, quality of groundwater, water level fluctuation, periodic monitoring data of water levels.	
Account of Existing Scenario	Water for drinking and domestic use-availability and sustainability as per local experience.	
Water Quality	Specific contaminant parameters to be considered. Urban slums to be surveyed for impact on water quality especially for ground water recharge.	
Authenticity and Availability of Data	Made secure and permanent; Reviewed and updated annually; Made accessible to the public.	
<b>Process</b>		
Catchment	Divide the area into watersheds/micro-watersheds of 500-1000 hectare size in Rural Areas 100-200 hectare size in open spaces of Urban Areas Here, watershed sizes should be kept flexible according to catchment rainfall conditions, terrain patterns, etc.	
Unit	Identifiable colonies can be effective units for the purpose. Households and buildings serve as major source of rainwater harvesting.	
Water Availability	Compute source water availability - Local water balance.	
Demand - Nature and Extent	Determine extent and type of demand. Drinking water to be given top priority.	
Type of Rainwater Harvesting	Decide the type of Rainwater Harvesting needed to meet demand based on technical considerations. For e.g. in Urban areas, is Rooftop Rainwater Harvesting with storage in cisterns appropriate, or integrated watershed management for enhancing surface water storage and recharge to groundwater. Promote household Rainwater Harvesting as per the local conditions.	
Adoption of Location Specific Techniques	Techniques of Rainwater Harvesting specific to hydrogeological situation at appropriate locations selected on scientific considerations to be decided, planned and designed.	
Local Availability of Raw Materials and Tools	Study of material and tools availability utilizing local construction material as far as possible.	
Local Human Resource Potential	Study of local human resources potential available, such as trained masons and artisans. Stakeholders must be involved in construction of structures.	



	RURAL AREAS	URBAN AREAS
Monitoring	Monitoring of impacts of Rainwater Harvesting structures. Local stakeholders should be involved.	
Advocacy/Promotion	Media to play a proactive role in popularizing Rainwater Harvesting as part of education curriculum and implementation of Rainwater Harvesting schemes in these institutes. School children to be exposed to Rainwater Harvesting techniques and its benefits, and schools should have their own Rainwater Harvesting for collecting and conserving water for different uses.	
<b>Financial Investments</b>		
Basic Initiator	Government, Non-government bodies (private sector) should play a role of basic initiator.	
Contributions	Local industries should contribute. If there is no industry in the area, a nearby industry, which uses the area as its hinterland, should contribute. Beneficiaries of Rainwater Harvesting structure should be required to make equitable contributions.	
Financial Schemes	Bankable schemes have to be launched with financial support from Financial Institutions. Financial support available from Government supported schemes like central sector, centrally sponsored schemes etc. Wide publication of all such schemes is required	
<b>Management</b>		
Water Users Association	Committees should be set up from amongst beneficiaries along with some technical expert to monitor the performance and benefits of the Rainwater Harvesting, to replicate and improve designs. All major groups must be represented in the committees. The Committees can play the role of the local regulatory authority for equitable distribution of water from Rainwater Harvesting. The groundwater recharged through Rainwater Harvesting efforts is the part of common pool resource, which needs to be equitably distributed for various users.	
Awareness Education	Appropriate capacity and awareness building activities need to be taken up. Beneficiaries should be properly trained on routine maintenance of the system. Training of trainers also needs to be taken up	
Regulation of Groundwater Exploitation	Withdrawal through electro-mechanical devices from groundwater needs to be controlled/regulated by local committee. Proper liaison should be maintained with government authorities and agencies.	
<b>Industrial complexes</b>		
Selection of Rainwater Harvesting System	Installation of Rainwater Harvesting appropriate to the hydro-geo-climatic situation in Industrial complexes should be mandatory.	
Recycling of Water	Recycling of water to be taken up to meet inhouse demand: minimize the water requirement as far as possible.	
Compensation for Extra Usage	Additional withdrawal of water from the area to meet demands need to be compensated by installing appropriate Rainwater Harvesting with their financial support.	
Monitoring of Impact of Industrial Activities on Water Resources	Monitoring of impact of industrial activities-including water withdrawal-on existing water resources, both in terms of quantity and quality, be done on regular basis as a part of their activities.	



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| 2. Bangladesh | 10. Japan        | 18. Tanzania        |
| 3. Brazil     | 11. Kenya        | 19. The Netherlands |
| 4. Canada     | 12. Maldives     | 20. Turkey          |
| 5. China      | 13. Mexico       | 21. Uganda          |
| 6. Cuba       | 14. Nepal        | 22. United Kingdom  |
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**As a follow up of  
the XII International  
Rainwater Catchment Systems  
Conference**

**IRCSA & AFPRO**

announce the Constitution of  
**Rainwater Catchment Society of India (RCSI)**

to address the issues of rainwater management by consolidating practitioners, scientists, academicians and advocates of rainwater management in India.

A new group has been formed to discuss about the catchment systems and rainwater management practices in the country.

To join this new Yahoo Group, you can send a blank e-mail addressed to [Rainwater-Catchment-Society-India-subscribe@yahoogroups.com](mailto:Rainwater-Catchment-Society-India-subscribe@yahoogroups.com)

Or you can visit the following link

<http://groups.yahoo.com/group/Rainwater-Catchment-Society-India/>

IRCSA Board has instituted Mr. D. K. Manavalan, Executive Director, AFPRO & Vice President – IRCSA, as President of RCSI.

Also visit IRCSA ([www.ircsa.org](http://www.ircsa.org)) and AFPRO ([www.afpro.org](http://www.afpro.org)) websites for updates and announcements about the RCSI.



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